What is claimed is that:

1. A crosslinked polyrotaxane comprising at least two molecules of polyrotaxane, in which a linear molecule is included in cavities of cyclodextrin molecules in a skewered manner, wherein the linear molecule has at each end a capping group to prevent the dissociation of the cyclodextrin molecules, the at least two molecules of polyrotaxane are crosslinked each other through chemical bonding, and a part of hydroxyl groups of the cyclodextrin molecules is substituted with a non-ionic group(s).

2. The crosslinked polyrotaxane according to claim 1, wherein the non-ionic group is a -OR group, and R is a linear or branched alkyl group having 1-12 carbons, a linear or branched alkyl group having 2-12 carbons and at least one ether group, a cycloalkyl group having 3-12 carbons, a cycloalkyl ether group having 2-12 carbons or a cycloalkyl thioether group having 2-12 carbons.

3. The crosslinked polyrotaxane according to claim 1, wherein the non-ionic group is a -O-R'-X group, and R' is a group resulting from removal of one hydrogen in a linear or branched alkyl group having 1-12 carbons, a group resulting from removal of one hydrogen in a linear or branched alkyl group having 2-12 carbons and at least one ether group, a group resulting from removal of one hydrogen in a cycloalkyl group having 3-12 carbons, a group resulting from removal of one hydrogen in a cycloalkyl ether group having 2-12 carbons or a group resulting from removal of one hydrogen in a cycloalkyl thioether group having 2-12 carbons, and X is OH, NH_2 or SH.

4. The crosslinked polyrotaxane according to claim 1, wherein the non-ionic group is a -O-CO-NH-R_1 group, and R_1 is a linear or branched alkyl group having 1-12 carbons, a linear or branched alkyl group having 2-12 carbons and at least one ether group, a cycloalkyl group having 3-12 carbons, a cycloalkyl ether group having 2-12 carbons or a cycloalkyl thioether group having 2-12 carbons.

5. The crosslinked polyrotaxane according to claim 1, wherein the non-ionic group is a -O-CO-R_2 group, and R_2 is a linear or branched alkyl group having 1-12 carbons, a linear or branched alkyl group having 2-12 carbons and at least one ether group, a cycloalkyl group having 3-12 carbons, a cycloalkyl ether group having 2-12 carbons or a cycloalkyl thioether group having 2-12 carbons.

6. The crosslinked polyrotaxane according to claim 1, wherein the non-ionic group is a -O-Si-R_3 group, and R_3 is a linear or branched alkyl group having 1-12 carbons, a linear or branched alkyl group having 2-12 carbons and at least one ether group, a cycloalkyl group having 3-12 carbons, a cycloalkyl ether group having 2-12 carbons or a cycloalkyl thioether group having 2-12 carbons.

7. The crosslinked polyrotaxane according to claim 1, wherein the non-ionic group is a -O-CO-O-R_4 group, and R_4 is a linear or branched alkyl group having 1-12 carbons, a linear or branched alkyl group having 2-12 carbons and at least one ether group, a cycloalkyl group having 3-12 carbons, a cycloalkyl ether group having 2-12 carbons or a cycloalkyl thioether group

having 2-12 carbons.

8. The crosslinked polyrotaxane according to any one of claims 1 to 7, which has transmittance of 80 %/mmt or more at 400 to 800 nm.

9. The crosslinked polyrotaxane according to claim 8, wherein the transmittance at 400 to 800 nm is 80 %/mmt at temperature of 0 to 90°C.

10. The crosslinked polyrotaxane according to any one of claims 1 to 9, wherein the crosslinked polyrotaxane has two times larger or more elastic modulus at 80°C than that at 25°C.

11. The crosslinked polyrotaxane according to any one of claims 1 to 10, wherein substitution of the hydroxyl group with the non-ionic group is 10 to 90%, preferably 20 to 80%, and more preferably 30 to 70% of the total hydroxyl groups of the total cyclodextrin molecules.

12. The crosslinked polyrotaxane according to any one of claims 1 to 11, wherein the cyclodextrin molecule is selected from the group consisting of α-cyclodextrin, β-cyclodextrin and γ-cyclodextrin.

13. The crosslinked polyrotaxane according to any one of claims 1 to 12, wherein the linear molecule is selected from the group consisting of polyethylene glycol, polyisoprene, polyisobutylene, polybutadiene, polypropylene glycol, polytetrahydrofuran, polydimethylsiloxane, polyethylene and polypropylene.

14. The crosslinked polyrotaxane according to any one of claims 1 to 13, wherein the capping group is selected from the

group consisting of dinitrophenyl groups, cyclodextrins, adamantane groups, trityl groups, fluoresceins, pyrenes, substituted benzenes, polycyclic aromatics which may be substituted, and steroids.

15. The crosslinked polyrotaxane according to any one of claims 1 to 14, wherein the cyclodextrin molecule is α-cyclodextrin, and the linear molecule is polyethylene glycol.

16. The crosslinked polyrotaxane according to any one of claims 1 to 15, wherein the linear molecule has the cyclodextrin molecules included in a skewered manner at an amount of 0.001 to 0.6 of a maximum inclusion amount, which is defined as an amount at which the cyclodextrin molecule can be included at maximum when the linear molecule has the cyclodextrin molecules included in a skewered manner, and the amount at maximum is normalized to be 1.

17. The crosslinked polyrotaxane according to any one of claims 1 to 16, wherein the at least two molecules of polyrotaxane are chemically bonded by a crosslinking agent.

18. The crosslinked polyrotaxane according to claim 17, wherein the crosslinking agent has a molecular weight of less than 2,000.

19. The crosslinked polyrotaxane according to claim 17 or 18, wherein the crosslinking agent is selected from the group consisting of cyanuric chloride, trimesoyl chloride, terephthaloyl chloride, epichlorohydrin, dibromobenzene, glutaraldehyde, phenylene diisocyanates, tolylene diisocyanates, divinylsulfone, 1,1'-carbonyldiimidazole and

alkoxysilanes.

20. The crosslinked polyrotaxane according to any one of claims 1 to 19, wherein at least one hydroxyl group of at least one cyclodextrin molecule in each of the at least two molecules of polyrotaxane is involved in crosslinking.

21. A method for preparing a crosslinked polyrotaxane comprising the steps of:

1) mixing cyclodextrin molecules and a linear molecule, to prepare a pseudopolyrotaxane in which the linear molecule is included in cavities of the cyclodextrin molecules in a skewered manner;

2) capping each end of the pseudopolyrotaxane with a capping group to prevent the dissociation of the cyclodextrin molecules, to prepare a polyrotaxane; and

3) linking at least two molecules of the polyrotaxane by intermolecularly binding cyclodextrin molecules in the at least two molecules of the polyrotaxane through chemical bonding, and

further comprising the step of substituting a part of OH groups of each of the cyclodextrin molecules with a non-ionic group:

A) before the step 1) of mixing to prepare the pseudopolyrotaxane;

B) after the step 1) of mixing to prepare the pseudopolyrotaxane and before the step 2) of capping to prepare the polyrotaxane;

C) after the step 2) of capping to prepare the polyrotaxane

and before the step 3) of linking; and/or

D) after the step 3) of linking.

22. The method according to claim 21, wherein the step of substituting is set after the step 2) of capping to prepare the polyrotaxane and before the step 3) of linking.

23. A material comprising a crosslinked polyrotaxane, wherein the crosslinked polyrotaxane comprises at least two molecules of polyrotaxane, in which a linear molecule is included in cavities of cyclodextrin molecules in a skewered manner, wherein the linear molecule has at each end a capping group to prevent the dissociation of the cyclodextrin molecules, wherein the at least two molecules of polyrotaxane are crosslinked each other through chemical bonding, and a part of OH groups of each of the cyclodextrin molecules is substituted with non-ionic group.

24. The material according to claim 23, wherein the material further comprises water and has strength enough to be self-standing.

25. The material according to claim 23 or 24, which has transmittance of 80 %/mmt or more at 400 to 800 nm.

26. The material according to any one of claims 23 to 25, wherein the transmittance at 400 to 800 nm is 80 %/mmt or more at temperature of 0 to 90°C.

27. The material according to any one of claims 23 to 26, wherein a weight ratio of the water to the crosslinked polyrotaxane (water : crosslinked polyrotaxane) is 1 : 99 to 99.9 : 0.1.

28. The material according to any one of claims 23 to 27, wherein the material comprises the crosslinked polyrotaxane in an amount of 0.001 to 0.99 g/cm^3 per volume of the material.

29. The material according to any one of claims 23 to 28, wherein the material has two times larger or more elastic modulus at 80°C than that at 25°C.